Providing Assured Mobility to the Unit of Action

A Monograph
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ABSTRACT

PROVIDING ASSURED MOBILITY TO THE UNIT OF ACTION by Major Richard J.E. Heitkamp, United States Army, 52 pages.

As an enabler to the most dominant land force in the world, engineers allow maneuver forces to close with and destroy the enemy. The concept of assured mobility uses a framework to increase situational understanding and results in a greater freedom to maneuver. The assured mobility framework is a proactive thought process that extends beyond equipment and sensor capability. The framework offers a systematic approach to analyzing the available maneuver assets to assure maneuverability of the force and to eliminate the enemy's ability to impede our ability to maneuver.

As defined by Army doctrine, "Assured mobility encompasses those actions that give the force commander the ability to deploy, move, and maneuver where and when he desires, without interruption or delay, to achieve the mission." This new doctrinal framework exploits superior situational understanding in order to gain an unsurpassed freedom of movement. As with the goal of transformation, the assured mobility framework is a planning process that enables the commander to see first, understand first, act first, and finish decisively.

The assured mobility framework is designed to leverage information to analyze the mobility requirements of the force. As a planning tool it facilitates a staff's ability to identify "predict to detect," "detect to prevent," and "predict to prevent" linkages in developing predominate situational understanding and a marked advantage in maneuverability of the force. The nucleus of the framework is preventing the enemy from limiting friendly maneuver and protecting the force from enemy effects.

This monograph will examine the required resources and integrated systems needed to provide assured mobility to the unit of action. At the core of the assured mobility framework is the need to gather and analyze key sets of data and information. Chapter 2 will outline the information and system integration requirements to provide assured mobility to the future force.

Two key components of assured mobility are the retrieval of available data and analysis of information by engineer and intelligence staff elements. These actions compose the foundation of the mobility common operating picture. The true difficulty in propelling the concept into results rests in the ability of the UA staff to gather the right data and integrate it into a useful picture of the environment. Chapter 3 of this monograph will identify the personnel and equipment capabilities of the UA to provide assured mobility.

Finally, this monograph will examine possible recommendations for putting the assured mobility concept into actionable information. Adopting a doctrine of assured mobility represents a fundamental change in the way mobility support is provided to maneuver forces. Designing, building, and fielding the equipment required for assured mobility may prove to be the costly, but comparatively easy step. The difficultly comes in having the right systems, experts, and organizations to transform the reams of data into a planning tool staffs use to provide

predominate situational understanding and a marked advantage in maneuverability of the force. Success in assured mobility results when situational understanding prevents the enemy from limiting friendly maneuver and protect the force from enemy effects.

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INTRODUCTION

The US Army Engineer School (USAES) recently published its capstone doctrine, FM 3-34, Engineer Operations. The established center of gravity of the manual is the new concept of providing assured mobility. The goal of the conceptual framework of assured mobility is providing the commander the ability to deploy, move, and maneuver where and when he desires, without interruption or delay, to achieve the mission. The concept is unique in that it applies to both current and future force units.[1]

It is difficult to understand how this concept is markedly different from the historic methods of providing mobility support. An engineer battalion or brigade commander may ask, "what makes assured mobility different than what we are doing today at the National Training Center (NTC) or our actions in Operation Iraqi Freedom (OIF)?" Part of this answer exists in capabilities provided by information, the newest element of combat power.[2] To truly achieve assured mobility forces must capture information and represent the data in a clear snapshot of the mobility common operating picture. In contrast to the typical modified combined obstacle overlay (MCOO) of legacy forces, the mobility COP is empowered from near real-time geospatial data and intelligence, surveillance and reconnaissance (ISR) feeds. It allows the commander to better visualize the area of operation when determining his intent, concept of the operation, and how best to maneuver his forces. To provide an accurate representation of the threat,[3] information and intelligence systems must be integrated to enable the development of the

[1]Field Manual 3-34, *Engineer Operation,* (Washington DC: Department of the Army, 1 February 2004,) 3-11.

[2]Field Manual 3-0, *Operations*, (Washington DC: Department of the Army, 14 June 2001), 4-3. Information now an element of combat power, 4-3.

[3]A potential threat or adversary may be a state, sub-state, non-state, or transnational actor.

mobility common operating picture as a tool to providing assured mobility prediction to the unit of action (UA).

Back to the question of how assured mobility is different from traditional mobility support. Assured mobility provides forces the ability to leverage the combat power of situational understanding to choose where to go and reduce the requirements for redundancy. Confidence in the information will provide the commander the confidence to reduce redundancy, thereby reducing his required resources. This monograph will examine the required resources and integrated systems needed to provide assured mobility to the unit of action.

At the core of the assured mobility framework is the need to gather and analyze key sets of data and information. The data may be as simple as bridge reconnaissance information on the reduced military load class of a damaged bridge. It may be as complicated as direct UAV or sensor feeds that require analysis and decision before their impacts are communicated across the force. Chapter 2 of this monograph will outline the information and system integration to provide assured mobility prediction to the future force.

Two key components of assured mobility are the retrieval of available data and analysis of information by engineer and intelligence staff elements. The data and information is then captured, or input electronically, and quickly distributed. These actions compose the foundation of the mobility common operating picture, the cornerstone of transforming assured mobility from a concept into an enabler of better mobility prediction and support. The true difficulty in propelling the concept into results rests in the ability of the UA staff to gather the right data and integrate it into a useful picture of the environment. Chapter 3 of this monograph will identify the personnel and equipment capabilities of the UA to provide assured mobility.

CHAPTER 1

Understanding Assured Mobility

> We cannot simply hang on to the capabilities that were appropriate in a prior century. We need to think things anew. We need to take steps that are bold and innovative and that will position us so that we can continue to provide peace and stability in the period ahead. And that takes transformation.
>
> Donald Rumsfeld, Secretary of Defense[4]

The transformation of the US Army has affected every facet of how the Army operates. Initiatives range from the black beret to the doctrinal foundations of employing forces. Historians contend that the nature of war has changed little but military professionals recognize that the conduct of war is continually developing as new concepts, technologies, and requirements emerge. As a reflection of these developments, military engineers are transforming the way they provide critical support to maneuver elements battling the contemporary threat.

Army and Engineer Mission Essential Tasks

Understanding the changes begins by understanding the mission essential tasks of the Army and how the tasks are mutually supporting. The mission essential task list, commonly referred to as the METL, derives from statutory requirements, operational experience, and strategies for the employment of the nation's military. They are expressed as operational statements of the Army's core competencies.

FM 1, The Army, establishes six mission essential tasks:

Shape the Security Environment.

Respond Promptly to Crisis.

Mobilize the Army.

Conduct Forcible Entry Operations.

Dominate Land Operations.

Provide Support to Civil Authorities.[5]

Similarly, Army engineers follow a METL that supports the essential tasks of the Army across the full spectrum of operations. Engineer support is provided in concert with other services and in conjunction with multinational and interagency organizations. The engineer regiment established the following seven mission essential tasks:

Shape the Security Environment.

Respond Promptly to Crisis.

Mobilize Engineer Forces.

Support Forcible Entry Operations.

Support Assured Mobility to Dominate Land Operations.

Provide Support to Civil Authorities.

Provide Quality, Responsive Engineering Services to the Nation.[6]

As an enabler to the most dominant land force in the world, engineers support decisive, shaping, and sustaining operations to facilitate success. Key in achieving success is providing the ability for maneuver forces to close with and destroy the enemy to achieve campaign objectives in support of national objectives. The freedom of maneuver throughout the area of operations is possible by providing bridging, clearing, detecting and neutralizing mines, and removing natural

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[4]Paul J. Kern, "AMC: Accelerating the Pace of Transformation," *Army Magazine*, vol. 52, no. 2., (February 2002). Accessed 3 March 04, http://www.ausa.org/armymagazine

[5]Field Manual 1, *The Army*, (Washington DC: Department of the Army, 14 June 2001), 3-1.

[6]Field Manual 3-34, *Engineer Operations*, (Washington DC: Department of the Army), 1-6 .

and man-made obstacles. The concept of assured mobility uses a framework to increase situational understanding and results in a greater freedom to maneuver. The assured mobility framework is a proactive thought process that extends beyond equipment and sensor capability. The framework offers a systematic approach to analyzing the available maneuver assets to assure maneuverability of the force. Not a concept confined to the future, assured mobility enables current force, Stryker, and future force units to employ situational understanding as a fundamental enabler to eliminate the enemy's ability to impede our ability to maneuver.

Assured Mobility Framework

The assured mobility framework is a product of the Objective Force.[7] It was originally designed to leverage information and the other elements of combat power to analyze the mobility requirements of the force. As a planning tool it facilitates a staff's ability to identify "predict to detect," "detect to prevent," and "predict to prevent" linkages in developing predominate situational understanding resulting in a marked advantage in maneuverability of the force. The nucleus of the framework is its ability to construct linkages preventing the enemy from limiting friendly maneuver and protecting the force from enemy effects.[8]

As defined by Army doctrine, "Assured mobility encompasses those actions that give the force commander the ability to deploy, move, and maneuver where and when he desires, without interruption or delay, to achieve the mission."[9] This new doctrinal framework establishes

[7] TRADOC Pamphlet 525-66, *Military Operations, Force Operating Capabilities,* (30 January 2003) 10-3.

[8] Jeffrey A. Bedey, and Ted Read, "Operationalizing Assured Mobility," *Engineer* (April 2002) 15-17.

[9] Field Manual 3-34, *Engineer Operations,* (Washington DC: Department of the Army) 3-12.

imperatives and fundamentals of assured mobility to enable friendly forces to exploit superior situational understanding in order to gain an unsurpassed freedom of movement. As with the goal of transformation, the assured mobility framework is a planning process that enables the commander to see first, understand first, act first, and finish decisively.[10]

Used as a planning tool, the elemental framework of assured mobility is composed of four imperatives that are linked to the elements of combat power. When used as a component of the Army's military decision making process (MDMP) the framework's imperatives are proactive, not reactive, and assure freedom of maneuver of the force.

- Develop the mobility common operating picture (COP)

The first imperative is the creation of a mobility COP for the entire area of operations (AO) through the collection and integration of geospatial, cultural, and enemy information. This information allows quick development of a geographical picture of the battlespace enabling the maneuver commander to select the operating areas within the AO. The commander uses the mobility COP as an enabler to focus resources to gain information domination. Domination is achieved when the enemy is identified and his options are constrained and eliminated.

The mobility COP is defined by the desired endstate and is updated with new information to reflect real-time mobility aspects. Developments and updates to the mobility COP are provided by a network of geospatial tools and intelligence, surveillance, and reconnaissance (ISR) capabilities. For example, integrated reconnaissance and surveillance give knowledge of existing obstacles and data on existing traffic patterns. These are two examples of how to update the COP displays of the battlespace in near-real time. The maneuver commander is empowered with this picture and better able to determine where he may maneuver, the resources required to make it

[10]Kevin P. Byrnes, "Accelerating Transformation," *Army Magazine*, (February 2003.) Accessed 3 March 04, http://www.ausa.org/armymagazine.

possible, and how the threat may attempt to influence his maneuver plan. Ultimately, assured mobility enables the commander with a dramatically improved sense-and-respond capability via the mobility COP. Forces are then focused to provide the greatest effect and the timeline of the "Observe" and Orient" portions of John Boyd's Observe-Orient-Decide-Act (OODA) loop may be compressed[11]. One's decision loops can be spun so rapidly that an adversary must work continuously to fight yesterday's battles.[12]

- Select, establish, and maintain operating areas

Just as important as maintaining the mobility COP is to provide the analysis required to make the battlespace picture a tool for planning. It provides the critical link between seeing first and understanding first. This analysis will better tailor the picture and assist in distinguishing the threat capabilities and intentions. Steps in the process include identifying the named areas of interest (NAIs), targeted areas of interest (TIAs), choke points, operating areas, and lines of communication (LOCs).

By accurately predicting and identifying the enemy's options and intent it is then possible to focus sensor and reconnaissance presence to more fully understand the operating area. The mobility COP provides understanding of enemy options by analyzing time, distance, range, and line of sight relationships. One method of providing assured mobility is through tactical decision aids, such as Battlespace Terrain Reasoning and Awareness (BTRA) applications. With these decision aids it is possible to transform raw terrain data into analysis for possible obstacle locations or lines of communication. The BTRA application is also able to provide a predictive

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[11]The OODA loop theory was developed by John Boyd to describe the psychological dimensions of the decision-making process. See John R. Boyd, *A Discourse on Winning and Losing* (Air University Press, AL, 1987).

[12]Arthur K. Cebrowski, "Network-Centric Warfare: A Revolution in Military Affairs," presentation to the 1997 Technology Initiatives Game, 8 September 1997.

analysis by tracking existing obstacles and developing threat patterns of what the threat may manipulate the terrain to impede friendly maneuver.[13] Friendly forces are then able to control and monitor critical mobility areas. By proactively coordinating a mobility plan in conjunction with the scheme of maneuver, the commander is able to identify the locations that may impede movement and resource where he wants to maneuver to avoid or neutralize these impediments while protecting the force and minimizing risks. This imperative supports the elements of protection and maneuver.[14]

- Attack the enemy's ability to influence operating areas

Once it is possible to identify and observe decisive terrain, it is then possible to allocate combat power and sensors to eliminate the enemy's ability to impede friendly maneuver. This is best accomplished by employing standoff detection and obstacle neutralization systems. Attacking obstacles in coordination with the maneuver plan through the standoff detection and neutralization of obstacles is critical to preserve resources. A proactive attack of the enemy's ability to employ obstacles eliminates the enemy's ability to shape the AO against friendly forces. Reducing the enemy's ability to influence operating areas is a key enabler for mobility. This ensures freedom of maneuver by shaping the noncontiguous operating area by maintaining mobility for decisive operations.

- Maintain mobility and momentum

By acting in concert with all Battlefield Operating System (BOS) capabilities to protect the freedom of maneuver, friendly forces are able to neutralize the effects of enemy obstacles.

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[13]TEC website, Combat Terrain Information Systems, http://www.tec.army.mil/ctis/about/main.html.

[14]FM3-34, 3-13.

This allows the seizure of objectives immediately and along multiple routes. Forces are able to maintain pressure and lethality as enemy threats are eliminated.

While the first three imperatives rely heavily on command, control, computers, communications, intelligence, surveillance, and reconnaissance (C4ISR) assets, the fourth imperative considers the thinking enemy who is able to influence our operations. It provides for the neutralization of obstacle effects in the context of friendly maneuver. Only as a last resort is the unit's organic breaching capability used to eliminate enemy obstacles.

Marking systems are then key to providing visual, virtual and active identification of obstacles and cleared or safe areas. Future marking systems are integrated into the common operating picture to update and notify follow-on units of open routes. Ensuring the flow of support through open lanes is a vital component of maintaining mobility and momentum by reducing obstacle effects for logistics and forward landing areas.

Assured Mobility Fundamentals

To understand the change in the mobility support, the assured mobility framework is best viewed as a means of integrating new capabilities and technology within the four imperatives previously discussed. Assured mobility provides maneuver forces a proactive approach to mobility through the use of information. It maximizes avoidance without committing forces into the threat's massed effects.

The assured mobility fundamentals are predict, detect, prevent, avoid, neutralize, and protect. They represent a perpetual cycle of planning, preparing, and executing full spectrum operations that support decisive, shaping, and sustaining objectives. At their core, the fundamentals characterize actions that sustain friendly maneuver ability and preclude enemy maneuver threats. Successful execution of these fundamentals depends on superior situational understanding, shared knowledge, and decisive execution.

Achieving assured mobility rests on applying the six fundamentals listed below:

- *Predict* actions and circumstances that could affect the ability of the force to maintain momentum.

- *Detect* early indicators of impediments to battlefield mobility and identify solutions through the use of ISR assets.

- *Prevent* potential impediments to maneuver from affecting the battlefield mobility of the force by acting early.

- *Avoid* detected impediments to battlefield mobility of the force, if prevention fails.

- *Neutralize*, reduce, or overcome (breach) impediments to battlefield mobility that cannot be prevented or avoided. The breaching tenets and fundamentals apply when forced to neutralize an obstacle.

- *Protect* against enemy countermobility effects.[15]

Assured Mobility in Action

> Those who do not know the conditions of mountains and forests, hazardous defiles, marshes, and swamps cannot conduct the march of an army.
>
> Sun Tzu, The Art of War

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[15]Bedey, 16.

Operation Iraqi Freedom

The first test bed of assured mobility doctrine occurred during Operation Iraqi Freedom (OIF). Inculcating the framework into planning and decision making was part of the preparations for deployment. Post war comments from participating units yielded positive support for the change in mobility support. Many comments spoke of the unit's efforts to transform to the assured mobility framework. As the comment from the commander of the 3rd Infantry Division's (3ID) Engineer Brigade indicates, "Ever since the division's warfighter in January 2002, the Engineer Brigade has focused on establishing TTPs to implement the emerging engineer doctrine of assured mobility.[16]" The unit also gave the framework high marks in their final comments, "The emerging doctrine of "assured mobility" provided a superior doctrinal framework for engineers to focus their efforts, but this operation implies a major overhaul of engineer training doctrine and tactics, techniques, and procedures (TTPs) must be undertaken to better prepare engineers how to fight in continuous offensive operations.[17]"

Geospacial technology was one type of information that was available and proved critical in enabling assured mobility to the maneuver forces. The forces of OIF used terrain analysis to provide assured mobility by identifying routes that were previously thought to be impassible. As expressed in the 3ID AAR, "Full utilization of a topographic detachment is critical to allow the commander to visualize the fight throughout the depth of the battlespace during planning and execution. These teams provided products that were essential to ensure common understanding of the terrain and the operation at all levels in the division.[18]"

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[16]After Action Review, Third Infantry Division, Operation IRAQI FREEDOM, 23 June 2003, Chapter 15, 143.

[17]Ibid., 144.

[18]Ibid., 144.

This geospacial information was used as the type of decision and planning tool envisioned by assured mobility theory. Again from the 3ID AAR, "The enormously detailed division terrain analysis conducted by the planners ensured the division developed executable plans. For example, the division cancelled branch plans to cross the Euphrates at multiple locations when imagery revealed that they were waterlogged. Additionally, a detailed analysis of roads and routes to the south of the Sulaybiyat Depression confirmed these roads were trafficable, allowing the division to attack initially along two major axes of advance.[19]" Our technology lead over the untrained and uniformed enemy allowed 3ID to implement assured mobility with current technology.

[19]Ibid., 146.

CHAPTER 2

Information Networking And System Integration

> From Plato to NATO, the history of command in war consists of an endless quest for certainty.
>
> Martin Van Creveld[20]

The previous examples of applying the assured mobility fundamentals in Operation Iraqi Freedom signal that assured mobility theory can be successfully employed now with current forces, equipment, and information sources. A better harnessing and integration of information is required to take the assured mobility framework to the next level of successful application. The strength in assured mobility theory is that enhanced situational awareness leads to actionable situational understanding.

Situational understanding is achieved by fusing information obtained through a layered network of soldiers, sensors, and collection platforms, with information on friendly forces, enemy forces, and the environment, to obtain a common operating picture that is shared across the force. This chapter discusses how information and systems are designed and integrated to provide the mobility elements of the COP. Ultimately it discusses how this information provides assured mobility and situational understanding to future commanders.

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[20]H.R. McMaster, *CRACK IN THE FOUNDATION: Defense Transformation and the Underlying Assumption of Dominant Knowledge in Future War*, Center for Strategic Leadership, US Army War College, November 2003 Volume S03-03 [online] http://www.carlisle.army.mil/usacsl/publications/ S03-03.pdf. The quotation is from William A. Owens, "Introduction," in Stuart E. Johnson and Martin C. Libicki, eds., *Dominant Battlespace Knowledge*, (Washington, D.C.: National Defense University Press, 1996), 4.

Command, Control, Communications, Computer, Intelligence, Surveillance and Reconnaissance

To fully understand the common operating picture and the mobility COP, one must have an appreciation for the architecture in which it is managed and distributed. Two critical elements in this process are the C4ISR domain and information network. "C4ISR" refers to systems that are part of the Command, Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance domain. C4ISR is the holistic term used in managing communications and the focused collection of information. The future force will be linked internally and externally through a responsive, reliable, mobile non-line-of-sight internetted C4ISR capability.[21] The C4ISR network is defined in the Joint Technical Architecture (JTA; Defense Information Systems Agency, 1999) as those systems that

• support properly designated commanders in the exercise of authority and direction over assigned and attached forces across the range of military operations;

• collect, process, integrate, analyze, evaluate, or interpret available information concerning foreign countries or areas;

• systematically observe aerospace, surface or subsurface areas, places, persons, or things by visual, aural, electronic, photographic, or other means; and obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or

[21]Edward J. Filiberti, James R. Oman, and James H. Thomas, *Army Transformation: A Case Study*, (U.S. Army War College, Carlisle, PA, 12 October 2001), 5.

potential enemy, or secure data concerning the meteorological, hydrographic, or geographic characteristics of a particular area.[22]

C4ISR systems provide all commanders in the future force with the capability to: see and understand dimensions of their battlespace; precisely locate and track critical targets; conduct simultaneous operations with lethal and nonlethal means; operate with joint and multinational forces; and recognize and protect their own forces and other friendly forces. These capabilities are critical for future forces to synchronize widely dispersed and highly mobile forces operating through an extended battlespace.

Mobility Common Operating Picture

As part of the C4ISR domain, the mobility COP is pivotal to the success of the future force by enabling the commanders to developing the situation out of contact. As such commanders and staffs will rely heavily on networked sensors and sensor fusion to establish and maintain the mobility COP. This section discusses the information and technology required to develop a timely and accurate mobility picture.

The creation of a mobility COP is the first imperative for providing assured mobility. This is a mobility picture composed of vectors of geospatial, cultural, enemy, friendly, civilian, and weather information required for situational awareness and rapid decision making. By expeditiously collecting and organizing the data points, the mobility COP is able to provide a single fused picture that contains near real time information of the battlespace enabling the maneuver commander to better visualize the focused operating areas within the AO.

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[22]John A. Hamilton, Jr., Jerome D. Rosen, and, Paul A. Summers, "An Interoperability Road Map For C4ISR Legacy Systems," *USAF, Acquisition Review Quarterly,* (Winter 2002) [online] http://www.dau.mil/pubs/arq/2002arq/Hamilton.pdf.

The use of the initial COP allows commanders to decide where they want to operate and focus assets to gain situational understanding. By decreasing the operating area into a smaller and better focused areas designated within the AO, the mobility COP provides the best resolution and enables the commander to anticipate positions of advantage and focus collection assets and efforts. This understanding enables the commander to maneuver to positions of advantage. The mobility COP analyses factors such as unit/vehicle capabilities, terrain, infrastructure, and weather. Commanders want to know "where can I move and where and when can the enemy influence my movements?" As a practical tool, the mobility COP provides the commander with these answers.

With the technological enablers currently available, the mobility COP is derived from improved geospacial information and a well-integrated ISR plan. In the unit of action (UA), the RSTA cavalry squadron typically executes the ISR plan, but with the integrated sensor abilities of the future force, any UA element is capable of capturing information important to the ISR plan. The ISR plan and sensor network are also integrated with national assets. Assigning reconnaissance missions may be unnecessary if the required information can be covered, assigned, or gained through reach-back assets at the national level. The UA is discussed in greater detail in chapter 3 but understanding the mobility COP requires a discussion on how the information is gathered in the future force. As described by TRADOC Pam 525-3-90, Operational and Organizational Plan, Maneuver Unit of Action:

> Ground reconnaissance units in every combined arms battalion are primarily designed to facilitate target acquisition and reconnaissance-pull for assured mobility. There are specific platforms within the UA, both manned and unmanned optimized for RSTA operations. These ground recon assets can operate in weather conditions that limit or prohibit air reconnaissance. In addition to aerial reconnaissance assets, each combat platoon has unmanned ground vehicles to provide organic reconnaissance to small units, significantly reducing the chance of tactical surprise. Aerial platforms, manned and unmanned, complement ground reconnaissance by greatly increasing the speed and depth of R&S operations that can be conducted over a given area. The air component is designed to operate easily over rugged terrain that hinders ground operations like swamps, mountains or deep snow. Aviation assets and organic UAVs can operated at

considerable depth, providing the commander with additional time to develop an operation inside the enemy's decision cycle. Technical systems in the UA conduct both surveillance and reconnaissance missions. Multi-mission radars and unattended ground sensors provide surveillance and can cue reconnaissance assets or can be cued by reconnaissance assets. UA sensors will be multi-platform, multi-functional systems with Measurements and Signatures Intelligence (MASINT), SIGINT, IMINT, Electro-Optic/Infrared, and CBRN capabilities. These families of ISR sensor systems enhance the commander's ability to "See First." Manned and unmanned ground and air vehicles, as well as unattended ground sensor systems, carry mission packages of sensors to the target on which they are collecting.[23]

Constructing the Mobility COP - Sensor Inputs

Constructing the mobility COP is accomplished by ground forces and sensor networks. Ground forces synchronize their efforts to develop the mobility COP through the use of an engineer ISR plans. The engineer ISR plan is integrated with the intelligence staff (enemy situation), geospacial teams (terrain, soil, infrastructure, route status, mapping), maneuver support (obstacles, mines, IED detection), and the command and control elements (friendly forces information). This ISR plan is executed by all of these elements to continuously develop and update the common operating picture.

The second component of building the mobility picture is through the use of sensors. A sensor network provides the "eyes" that make the assured mobility framework possible. The ISR and target acquisition systems feed information derived from sensors into the mobility COP. With the additional information from automated friendly force identification, status tracking, and system monitoring on friendly forces, the complete COP is produced.

Networked sensors will enable the commander's ability to attack enemy formations with beyond-line-of sight (BLOS) and non-line of sight (NLOS) fires and avoid surprise encounters

[23]Change 2 to TRADOC Pam 525-3-90, *O&O "The United States Army Objective Force Operational and Organizational Plan Maneuver Unit of Action,"* Unit of Action Maneuver Battle Lab, Fort Knox, KY 30 June 2003.

with such entities as noncombatants, minefields and other manmade or natural obstacles and chemical, biological, radiological, and nuclear (CBRN) elements.

Sensor fusion is the process by which data generated by multiple sources is correlated and analyzed to find the enemy and create situational understanding. Understanding this process requires a new understanding of how sensors are integrated throughout the future force. Sensors include combat platforms and soldiers, organic manned and unmanned reconnaissance and surveillance platforms, and external constellations. Once the information is gathered, sensor fusion provides the automated and manual correlation and analysis to turn raw data into situational understanding. There are several requirements for fusion. First is to gather information. The fusion process, operating over integrated communications networks, includes accepting data from all ISR sources, organic and external. The second requirement is to draw relationships between source inputs. Fusion ensures that information is not stove-piped, but is fully exploitable across the entire force. The final requirement of fusion is to provide meaning or situational understanding from the data and relationships acquired. This is the most important function of fusion, quickly converting data into actionable information.[24]

Terrain Data Acquisition Obtained Rapidly

The Army's baseline system for managing terrain data is the Digital Topographic Support System (DTSS). DTSS provides Engineer Terrain Teams at Brigade, Division, Corps and Echelons Above Corps (EAC) the automated tools required to perform analysis of terrain and create topographic products within the time frames required by today's Army. The newly designed terrain team for the future UA is discussed later in the monograph.

[24]Chapter 4. Sensor Fusion, TRADOC Pam 525-66, *Force Operating Capabilities*, 30 January 2003, 31.

The DTSS receives, formats, stores, retrieves, creates, updates and manipulates digital topographic data. These capabilities are used to provide topographic products to users in soft- or hard-copy form faster than the current manual process. Typical products include: on- and off-road mobility maps, line-of-sight intervisibility plots, concealment maps, on-road choke point maps and tactical fording/bridging maps.

The DTSS accepts topographic and multi- spectral imagery data from the National Geospatial-Intelligence Agency, formerly the National Imagery and Mapping Agency (NIMA), standard digital databases, and from commercial sources. DTSS functional capabilities include the creation of intervisibility, mobility, environmental, 3– D terrain visualization, and special-purpose products; and the creation, augmentation, modification, and management of topographic data. The DTSS provides updated terrain intelligence information to all Army Battle Command System (ABCS) workstations on the battlefield, and accept terrain intelligence/ data updates from these systems.

Data Under Control--Geographic Information System

An emerging tool to assured mobility is a geographic information system (GIS). GIS is a computer-based system for capture, storage, retrieval, analysis and display of spatial (locationally-defined) data. In practice it is essentially an interface for querying, analyzing and viewing special databases. Defining the mobility COP requires more an examination of the intervisability lines common during NTC rotations. The increasing occurrence of urban operations ratifies the need for a system to examine the roads, bridges, buildings, and other infrastructure of an area of operations. The GIS system is uniquely designed to this knowledge. GIS allows assured mobility practitioners to examine, analyze, and collaborate on common geographic features. A typical use may be for a planner to quickly determine a route and query for any bridges under a certain military load class.

As with many computer applications, the integration from a civilian system to the military's information database, ABCS and the maneuver control system (MCS), has been a slow one. The military systems are not capable of a simple crosstalk with industry-standard GIS data. The future battle command system and future versions of the current Army Battle Command System (ABCS) under development may allow for better integration.[25]

[25] Jack Haefner and, Ross Guieb, "GIS as an Assured Mobility Enabler," *Engineer* (April 2002) 15-17.

CHAPTER 3

Assured Mobility In The Unit Of Action

> Force does not exist for mobility but mobility for force. It is of no use to get there first unless when the enemy arrives, you have also the most men--the greater force.
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> RADM Alfred Thayer Mahan, Lessons of the War with Spain[26]

The design of the Unit of Action (UA) offers the first glimpse of how assured mobility can be provided in future forces. The UA is designed to strike a balance between size and capabilities by integrating the force multiplier of information via technology. The composition of forces and equipment to accomplish the desired effects must be able to deploy within the set time constraints. The design of UA forces enables them to deploy directly into operational locations where they can implement immediate combat operations.[27]

This chapter discusses the history of transformation and how the design of the UA supports providing assured mobility. By reviewing the events leading to the design of the UA and analyzing the personnel, organizations, and equipment of the unit, one can gain a better understanding of how assured mobility is employed in the future force. It is also evident why mobility is so significant to a deployability-focused force with less armor, firepower, and maneuverability than current forces.

The UA organization is one that can destroy enemy mounted and dismounted forces out of contact. It also has highly lethal and rapid firing systems available organically to meet and

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[26]Alfred Thayer Mahan, *Lessons of the War with Spain, and Other Articles*. (Boston: Little, Brown, 1899). Reprint. Freeport, NY: Books for Libraries Press, 1970.

[27] The Army 2003 Transformation Roadmap, 1 November 2003, accessed http://www.dtic.mil/jointvision/army_trans_roadmap.pdf.

destroy mounted and dismounted forces encountered unexpectedly at relatively close range. The UA design reflects these requirements while providing a combat configuration that is 100 percent mobile and self-sufficient for up to 72 hours of high intensity contact. Forces are equipped with organic sensors, effects, and ISR capabilities. Each echelon is linked to the joint command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) architecture enabling it to shape the battle at the lowest level feasible. Revolutionary situational awareness and understanding enable the UA commander to task his assets effectively. UA forces operate on a dispersed battlefield in accordance with the commander's intent. Each element contributes to the massing of effects for the entire force as well as responding to immediate combat demands.[28]

Although it is a force designed for the future, the UA is capable of operating seamlessly within legacy, interim, coalition, combined, joint, multi-national, and interagency command structures. It must also be capable of accepting additional combat battalions or modules of other forces without over-extending the ability of the force's C4 structure to command and control the force. Units detached from or attached to the UA must be capable of immediate interface, at all levels, with the gaining command. This ensures the common operational picture (COP) is equally distributed through out the force. The combined information of the COP, reconnaissance data, and intelligence assets are instrumental in providing assured mobility to the UA. As described by TRADOC Pam 525-3-90, Operational and Organizational Plan, Maneuver Unit of Action:

> Assured mobility is a key capability of the UA. Small units in the UA achieve assured mobility by moving with a reconnaissance-pull to parallel routs around enemy forces to positions of advantage. In reconnaissance –pull, UA Commanders use intelligence that feeds the DIDb in an interactive and iterative way. He obtains combat information from his R&S assets to develop a COA. In the UA, intelligence is developed from R&S assets

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[28]US Army White Paper, *Concepts for the Objective Force*, 15. Accessed http://www.army.mil/features/WhitePaper/ObjectiveForceWhitePaper.pdf.

and displayed in near-real time on the COP. This rapid dissemination of actionable information results allows units to collaboratively alter the plan while on the move, attacking enemy weaknesses and seams and avoiding his strengths[29].

The History of Transformation

Long before the end of the Cold War, the Army realized that the information revolution held radical possibilities for the effectiveness of ground forces and significant changes in their organization. Some of this can be linked to the Soviet Union in the 1970s in their military journal discussions of what they termed the "military technical revolution." The US Army continued this discussion in the 1980s by terming this change the "revolution in military affairs."[30]

In the 1990s the Army officially pursued these theories through a series of experiments and initiatives to include projects like Army After Next and Force XXI digitization. These initiatives were built on the premise that the stable paradigm of a large-scale, high-intensity conflict with the Soviet Union would give way to a series of diverse operations in disparate locations. The pivotal event in the current transformation process did not come with the events of September 11, but many years earlier during operations in Kosovo with Task Force Hawk, part of Operation Allied Force. In 1999, a new Army Chief of Staff, General Shinseki, determined to reform Army organization based, in part, on the experience of Task Force Hawk, the only significant Army participation in Operation Allied Force.

[29]Change 2 to TRADOC Pam 525-3-90 *O&O "The United States Army Objective Force Operational and Organizational Plan Maneuver Unit of Action,"* Unit of Action Maneuver Battle Lab, (Fort Knox, KY 30 June 2003.)

[30]Bruce R. Nardulli and Thomas L. McNaugher, edited by Hans Binnendijk, *Transforming America's Army*, Chapter 4, "The Army: Toward the Objective Force." Center for Technology and National Security Policy, National War College., Washington, D.C., August 2002. Accessed [online] http://www.ndu.edu/inss/ books/Books_2002/Transforming%20Americas%20Mil%20-%20CTNSP%20-20Aug%202002/01_toc.htm.

Task Force Hawk was designed to deploy a force with twenty-four Apache helicopters to conduct deep strikes against Serbian Army units in Kosovo. As support and security requirements were added, the task force grew from a planned deployment of just under 2,000 soldiers to a force of approximately 6,000 soldiers. This included a maneuver battalion task force of forty-two Bradley Fighting Vehicles and twelve M1A1 tanks, twenty-four Multiple Launch Rocket Systems. Additionally, the command and control element required a large headquarters and twenty-five expandable vans mounted on 5-ton trucks.

The resulting airlift to deploy Task Force Hawk required five hundred fifteen C-17 sorties. The deployment was not to a modern airbase but rather the force deployed into and operated from a small Albanian airfield surrounded by mud and standing water. These inhospitable facilities were also home to twelve other NATO units and multi-national organizations. To make the site functional the Army brought in massive amounts of crushed rock and built helicopter-landing pads. Regardless, the airfield and surrounding area still became a quagmire with clutters of munitions, repair parts, humanitarian supplies, vehicles and equipment. Although Task Force Hawk met its deployment schedule, it arrived later than many expected, including General Wesley Clark, the Supreme Allied Commander, Europe. Americans viewed TV images of soldiers wading through the mud in a small and distant corner of the world. Civilian and military leadership turned their attention on Army organization and Kosovo seemed a metaphor for what needed to change in the Army. Forces needed to be faster and lighter.

The operations in Kosovo reached an even darker state when two Apache pilots were killed in a training accident. Many involved believed the unit was not prepared to operate at night in the demanding mountainous environment. Slow, muddy, and possibly unprepared, any remaining interest in using Task Force Hawk waned and the unit was never employed.[31] It was a profound embarrassment for the Army.

The Army was behind in organizational change and suffering from a degradation in readiness and morale. General Shinseki resolved to make immediate and substantial changes. The physics of military science was clear that the heavy force was powerful and possessed operational mobility but was difficult to deploy and dependent on a large logistical infrastructure. On the other end of the extreme, the Army's airborne and light infantry units possessed strategic mobility, but suffered from a lack of mobility, firepower, and protection once they arrived in a theater of operations. No historical lesson of this is more clear than the opening chess moves of Dessert Storm when the 82nd Airborne Division was quickly deployed to stand alone against the impending Iraqi Army.

The Army responded by discontinuing its Force XXI program and shifted efforts to a three prong force, captured in the now famous transformation trident chart. The two new initiatives were the Interim Brigade Combat Team (IBCT) and the Objective Force. The IBCT was to fill the short-term need for a strategically mobile force that possessed greater mobility and firepower than a light unit. The IBCT was needed as an immediate stopgap measure until the Objective Force could be built and fielded. The Objective Force had its roots in an earlier Army After Next initiative, a research and development effort to determine the optimal Army organization for 2020 and beyond. Many of the same developers who worked on the Army After Next and Interim Force concepts were instrumental in later designing the Objective Force's Unit of Action.

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[31]Bruce R. Nardulli, Walter L. Perry, Bruce Pirnie, et. al., *Disoriented War: Military Operations in Kosovo*, 1999, (Washington, DC: RAND, 2002), 57-97.

Between 1999 and 2003, the Army defeated efforts to obstruct the formation of the IBCT, renamed the Stryker Brigade Combat Team (SBCT), and the Army began fielding the first three of six of these units in record time. In 2002, the Army moved up dramatically the target fielding date of the first Objective Force Unit of Action (UA) from 2015 to 2010, cancelled many programs, and shifted funds to research and development.[32]

Stryker Brigade Combat Team, Vanguard to the Future Force

The Stryker Brigade Combat Team (SBCT), originally titled the Interim Brigade Combat Team (IBCT), is the Army's response to expected changes of the operational environment caused by the end of the cold war and the need for future forces to deploy quickly. The nation and the Army needed to build a landpower force capable of strategic dominance across the full spectrum of operations. The new Army Vision announced in October of 1999 established an explicit requirement for the Army to rapidly become more strategically responsive.

Realizing that the normal DOD development and acquisition process would not be able to meet the envisioned timelines for such a force, the Army jump-started the transformation process. By using "off-the-shelf" technology and available equipment, the Army cut the research and development requirements and drastically reduced the time required to field new SBCT equipment. The SBCT is equipped with state of the art medium armored vehicles (MAVs) "at the threshold state" with remaining requirements satisfied by some "in-lieu-of equipment." Subsequent SBCTs will then be "equipped with almost all TOE (table of organization and equipment) MAVs and equipment and some in-lieu-of items. Equipment will also have some P^3I

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[32]Bruce R. Nardulli and Thomas L. McNaugher, "The Army: Toward the Objective Force," in Hans Binnendijk, ed., Transforming America's Military, p. 101-128. [Online] http://www.ndu.edu/inss/books/Books_2002/Transforming%20Americas%20Mil%20-%20CTNSP%20-20Aug%202002/01_toc.htm On funding shifts, see "Objective Force Funds Boosted At The Expense Of Legacy Efforts," Inside The Army, (February 3, 2003), 14.

(pre-planned product improvements) technical insertions to provide enhanced capabilities. Deliveries of the MAVs commenced after only 18 months from the original request. Developing this type of vehicle independently would have taken five to 10 years.[33]

The SBCT represents the first unit trained, manned, and equipped to meet that vision; the vanguard of the future force. Currently, there are two Stryker Brigades at Fort Lewis, and there are plans to stand four others up in Schofield Barracks, Hawaii, Fort Wainwright, Alaska, Fort Polk, Louisiana, and the last in Pennsylvania (National Guard).

In future operations political restrictions from both national and international influences will limit the size, composition, and timetable of forces deployed. Restraints may be particularly restrictive for initial deployments. This is one of the factors that governed the design of the SBCT. The design was also heavily influenced by the skillful application of niche capabilities through the use of advanced technologies. Much of this technology is directly linked to integration of advanced communications, information, the COP, the mobility COP, and assured mobility. Although the organization of the SBCT resembles that of a separate brigade, it is designed as a divisional brigade capable of fighting as the first-to-deploy brigade under a division headquarters.

Robust C4ISR capabilities and mobility enablers empower the SBCT to fight with a new tactical paradigm. Maneuver forces previously made contact with the enemy, further developed the situation tactically, and then maneuvered to a position of advantage for decisive action. With an increased understanding of the environment provided by situational understanding and assured

[33] Robert K. Ackerman, "It's not about outgunning the opposition-the first shot wins," *Signal Magazine,* July 2002, accessed 3 March, http://www.afcea.org/signal/archives/content/July02/army-july.html. Interview with Claude M. Bolton Jr., Assistant Secretary of the Army for Acquisition, Logistics and Technology, Signal Magazine, Army Views Other Services as Transformation Template.

mobility, the SBCT commander can develop the situation out of contact, maneuver rapidly out of contact to positions of advantage, and then dictate contact at the time and place best suited to his advantage.

Staff and Information Integration

The UA staff structure is comprised of a multiple of organizational cells. While this includes the traditional staff sections of personnel, operations/training, and logistics; it also includes a maneuver support cell as part of a six cell special staff group. The formulation of a maneuver support cell in the SBCT headquarters provides the ability to plan, integrate, and synchronize mobility operations with the combat brigade's scheme of maneuver. The SBCT's senior engineer brings knowledge and experience in maneuver support to the SBCT and facilitates integration of augmentation forces, local contractors, and local government agencies. This includes retrieving and updating mobility information, enhancing situational awareness, and synchronizing engineer operations. The maneuver support cell develops engineer ISR to provide continuous updates to the COP, ensuring it accurately reflects all obstacle and trafficability information in the area of operations.

The entire premise of the SBCT concept is predicated on the ability of the force to use information to develop a level of situational understanding that adds the lethality and effectiveness able to strike the balance between strategic responsiveness and the requirements for battlespace dominance. To develop this level of situational understanding, the SBCT requires the most advanced level of C4ISR seen in modern forces. Creating and planning C4ISR is managed through multiple centers and pathways to the networked C4ISR organization. Enabling this network are the intelligence staff, the military intelligence company, the signal company, the RSTA squadron, and the maneuver support cell.

Success to the SBCT relies heavily on the integration of these staff elements and the continuous process of situational understanding. These actions enable the SBCT to use technology to facilitate, strengthen, and accelerate the command and control process. This is accomplished by a robust C4ISR system capable of supporting the future force. It includes communications that are highly mobile with secure digital, voice, data, and video capabilities able to withstand the dynamic environment of future operations. The situational understanding is managed via an advanced database with feeds of friendly forces, maneuver service support data, and threat locations.

The staff elements conduct planning within the framework described in existing doctrine, such as FM 101-5. The manner in which the planning is executed is completely different than that of current forces. SBCT planners leverage the technological capabilities afforded by ABCS and C4ISR to conduct distributed, collaborative, and simultaneous decision-making. This provides for a planning methodology that is inherently rapid, focused and enables the commander to "see," decide, and seize opportunities. The advantages of a network collaborative environment enable the SBCT commanders and staffs to exchange ideas and plans from their current locations with simultaneity without the requirement to physically collocate.

As one of the pivotal enablers to the C4ISR network, the intelligence section is linked to the higher employing headquarters and conducts analysis and fusion of information and multi-disciplined intelligence in a collaborative environment. The section relies on "reach-back" to outside sources to obtain intelligence products, analysis, and database information essential to mission success. To package and disseminate this knowledge, the intelligence section uses visualization and collaborative tools to support and distribute analysis.

Several other elements of the staff are critical in developing the situational understanding of the environment. While the intelligence and maneuver support staffs are the obvious integrators for assured mobility, the public affairs officer, staff judge advocate, psychological operations officer, and information operations cell provide important assessments in developing situational understanding.

Weather analysis is an important component to completing the mobility picture. The Staff Weather Officer (SWO) uses the integrated meteorological system to digitally disseminate forecast data and weather impacts on current and future operations. While weather changes are fundamental planning any operation, they are especially important to mobility of the force and providing the prediction element to assured mobility. Weather analysis provides planners with additional data to better understand how the natural environment will effect systems and operations. For example, cloud, wind, and rain information are critical in planning ISR missions for UAVs and ground forces. Weather data is seamlessly integrated into the common operating picture and weather analysis provides the information to predict how operations and systems are altered. Direct implications for the mobility common operating picture include estimates for trafficability, fording site capabilities, and movement rates.[34]

RSTA Squadron

The RSTA squadron is a unique organization specifically designed to meet the unique operational requirements of the SBCT. It serves as the primary source of combat information and provides crucial links to an accurate mobility COP and providing assured mobility. To enable situational understanding, the RSTA moves beyond traditional enemy-focused reconnaissance and seeks to better understand the operational environment in detail, creating an umbrella of understanding across the AO. As with the design of the UA, the RSTA and all reconnaissance and intelligence assets are key to providing the mobility COP for assured mobility to the SBCT.

[34]Pat Hayes, "Weather Support to the Objective Force," unpublished web page, .http://www.asc2002.com/summaries/e/EP-10.pdf, accessed 11 April.

Maneuver Support Coordination Cell

The engineer staff with in the SBCT provides the capability to plan, integrate, and synchronize mobility operations in the deep, decisive, and sustaining fight. It is robust enough to enable limited 24-operations and coverage across the brigade's planning cells. Manned with two officers (one engineer major and one engineer captain) and two senior noncommissioned officers (one engineer master sergeant and one combat engineer sergeant first class), the maneuver support coordination cell coordinates all military and civilian engineer efforts in the area of operations.

The cell is also the source for terrain visualization and topographic support. Manned with a terrain team of a topographic warrant officer, a senior topographic noncommissioned officer and three terrain analysts; the cell is the topographic link to providing assured mobility through an accurate and updated picture of the battlespace. As discussed earlier, the terrain team is equipped with the Digital Topographic Support System. Topographic support provides the SBCT with terrain analysis from collected terrain specific data, georectifed, corrected then overlaid as map layers to provide digital terrain products of the AO. These digital products allow overlaying of existing, natural, and reinforcing terrain obstacles, friendly, and enemy positions. Informed with these products, leaders are able to make maneuver decisions based on the mobility options of the actual terrain. Topographic reconnaissance capabilities are developed from the collection and analysis of environmental data, such as weather and terrain, and the impacts to both friendly and enemy operations. The geospatial analysis results from enhancement of aeronautical, hydrographic, geodetic, and topographic data for the area of operations. Ultimately, the mobility is achieved from the careful integration of information and sources in the maneuver cell, the RSTA squadron, the intelligence staff, and the engineer company.

Physically and operationally integrated into the SBCT main tactical operations center (TOC), the cell is the focal point for all maneuver support planning and representation in the military decision making process. The cell can also be task organized to support other command and control nodes. The capabilities of the maneuver support cell and the terrain team provide digital dissemination of information for mobility planning. It manages the "dirty battlefield" database pinpointing the location of obstacles, mines, munitions, unexploded ordinance (UXO), and NBC hazards. The cell provides support critical to assured mobility by fusing information vital to the development of the mobility COP. With a clear picture of the mobility options and challenges, the commander can husband and tailor the limited mobility assets of the SBCT.

Engineer Company

As the mobility enabler for the SBCT, the engineer company is an agile organization focused on providing freedom of maneuver across the battlespace. The company is structured with a company headquarters and three combat mobility platoons and a mobility support platoon. It is capable of operating as a pure element or task organized with platoons supporting maneuver forces.

Mobility forces work in the offense providing mobility through obstacle and fortification reduction. Organic systems include false signature generators, explosives, rollers, plows, and dismounted combat engineer equipment. Situational obstacles limit the threat's ability to maneuver and prevent repositioning or delay counter attacks. In complex and urban terrain engineer support is able to identify unique obstacles and considerations such as culverts and sewer lines. Above surface considerations are made for power lines, communications systems, and water distribution conduits. Here an extensive use of robotics is possible to detect mines, booby-traps, explosives while reducing the threat to friendly forces. Information on the sewer or subway networks, along with other engineer-specific data is required to enhance the mobility picture.

The mobility support platoon has three sections to provide the enabling equipment to facilitate freedom of maneuver, reduce force exposure to direct and indirect fires, and increase force effectiveness in complex and urban terrain. The addition of robotic capability in the future will continue to provide essential mobility support while protecting tactical mounted and dismounted forces. The platoon is also capable of supporting mobility with tactical bridging. Hasty crossings can also be developed by improving fords and crossing-site reconnaissance.

Engineer forces are capable of reconnaissance to provide continuous updating of the SBCT's knowledge base for the common operating picture. The COP will then reflect obstacles and trafficability information in the area of operations. The engineer company does not have dedicated reconnaissance assets but with measured risk, can augment the RSTA squadron. Tailored reconnaissance operations can include the development of a detailed enemy obstacle template. Engineers are also available to monitor named areas of interest to gain information of terrain, obstacles, and areas for exploitation by maneuver forces.

Unfortunately, the engineer company, although part of the Stryker Brigade and originally templated for the UA design, is not currently part of the UA organic structure. Personnel and equipment constraints rather than desired UA mobility capabilities were the biggest factor in the elimination of the engineer company from the final UA design. The impacts and significance of this decision are further discussed in Chapter 4.

Benefits of the UA Design

This review of the UA design and its ties to supporting assured mobility lend a better understanding how the future force will leverage information to achieve success. The design of the UA enables the commander with more rapid decision-action cycles, with much less effort required to understand what is happening. The staff uses information and technology to provide an automated, running estimate of the situation; an abbreviated, continuous planning cycle incorporating predictive analysis; and the rapid generation and dissemination of mission orders. The result is increased freedom of maneuver and action that are preserved longer with a greater ability to cause the enemy to see and understand last, or wrongly. As the staff organizations, information management, and information integration continue to be refined, near-simultaneous updates in current information, will enable successful battle command.

CHAPTER 4

Recommendations

> Absent innovative thought and a willingness to integrate social advancements, triumphant warrior systems frequently become fossilized in their moment of glory.
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> John Keegan, A History of Warfare[35]

In a review of the previous chapters, it is evident that the assured mobility theory and framework is one that is possible with our current technology and capable of major growth as the Army continues to expand information networks and sensors. The first three chapters outlined assured mobility theory and how the integration of assured mobility enablers is key to providing actionable information. This final chapter will review the limitations and shortfalls in implementing assured mobility theory and make recommendations. These limitations can be viewed in the same doctrinal framework and imperatives that establish assured mobility theory.

Develop The Mobility Common Operating Picture (COP)

The first imperative is the creation of a mobility COP for the entire area of operations (AO) through the collection and integration of geospatial, cultural, and enemy information. This information allows quick development of a geographical picture of the battlespace enabling the maneuver commander to select the operating areas within the AO.

Geospacial Support

There are several challenges to providing the geospacial support required for assured mobility theory and the mobility COP. The fielding of the Digital Topographic Support System (DTSS), as discussed in chapter 2, and the increased capability of the terrain team in the SBCT have significantly improved the geospatial support in the past five years. Topographic information is one of the ways current forces are able to capture unique information to support the mobility of the force. Despite the success of these efforts, current capabilities do not meet the requirements for the future force. One shortfall is the availability of accurate, robust, and timely geospatial data for worldwide missions. With anticipated missions in some of the most remote corners of the world, it is conceivable that topographic support could be impossible due to a lack of topographic data. The National Geospatial-Intelligence Agency, formerly the National Imagery and Mapping Agency (NIMA), serves as the primary outside source for geospatial data and imagery. Their data typically available falls well short of requirements for assured mobility. Resolutions normally available are Digital Terrain Elevation Data (DTED) level 1 or 2 with a corresponding spacing of 30 to 100 meters. Terrain teams require data and imagery with one meter spacing. Similar to focusing ISR capabilities to a small area of the AO, terrain teams need to have the capability to generate geospatial data internally and reach-back for detailed data. Current equipment has a very limited ability to rapidly generate focused geospatial data.

The Army is also struggling to afford manning C4ISR capabilities in legacy units. This is true of topographic support. There are still seven of the active Army divisions that have nine-person terrain teams, as opposed to the capabilities of the 36-person terrain team found in a digital division. Additionally, the UA structure does not have a terrain team in the headquarters structure. To compound problems, the organizational structure of the geospatial support is confusing and convoluted with no clear lines of command, authority, and responsibility.

As discussed throughout the paper, a principle premise of a successful future force and assured mobility is the ability to "reach-back" to robust home-station operating centers (HSOC)

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[35]John Keegan, *A History of Warfare*, (Random House, Inc., 1993).

to rapidly gain information and data. Unfortunately, the ability of HSOCs to provide this information is limited. Restrained by communication systems and organizational capacity, Many HSOCs are not resourced to fill this role. The envisioned Army HSOC for topographic data is the Army's Topographic Information Center (TEC). However TEC's current organization and communications network would have to be expanded greatly to meet the requirements of current and future force units. This is especially true as engineers reach-back for the data required to develop the mobility COP.

When reach-back HSOCs are capable of providing the required data, equipment shortfalls prevent successful transmissions. The DTSS requires upgrades to rapidly generate data for multiple sources, such as UAVs, sensors, satellites, and HSOC networks. As further steps make this data generation process more automated, terrain teams can devote more energy to analyzing the data and less in generating it.

These changes are not easy ones. The topographic and geospatial communities are known for their parochialisms and ridged stovepipes. Additionally, the engineer and intelligence communities have an internal battle waging over the blurring lines of geospacial support and ultimate proponency. Successful transformation and integration will require the support of the National Geospatial-Intelligence Agency, the Battle Command Battle Laboratory, the Military Intelligence School, the Engineer School, and TEC.

Bandwidth Supply

As with other digitization efforts and transformation initiatives, providing assured mobility requires significant bandwidth for the accompanying information network. Although a detailed examination of these challenges is beyond the scope of this paper, In plain terms, the bandwidth supply will improve greatly with the fielding of the new tactical and operational-level communications systems. Even with the improved equipment, bandwidth supply remains a significant issue, especially at the battalion and brigade level. The cost of "buying" more bandwidth is prohibitive. The Army must look at new and innovative ways to better harness the bandwidth currently available.

Recently the Congressional Budget Office (CBO) conducted a study to analyze the current and future total demand for communications bandwidth to support operations officers at all levels of command within the Army. The CBO compared that demand with the total bandwidth supplied by communications systems in place today and those planned for the future. CBO's analysis shows that at all levels of command within the Army, the current demand for bandwidth is larger than the supply. Shortfalls were as much as 10 times the amount of supply. Additionally, shortfalls in bandwidth supply will persist at some command levels even after new communications systems are fielded. These systems include the Joint Tactical Radio System (JTRS), Warfighter Information Network-Tactical (WIN-T), and Multiband Integrated Satellite Terminal (MIST). The WIN-T and MIST are major components of the Army's plans to improve communications between the brigade, division, and corps command levels (known as the upper tactical Internet). The JTRS is the primary communications device for brigade and smaller units (known as the lower tactical Internet).

The CBO examined several options to either improve the future match between bandwidth supply and demand or lessen the risk of the shortfall. Its analysis considered three general approaches: boosting the amount of bandwidth above the increases already envisioned in the Army's programs, reducing the demand for bandwidth, and better managing the mismatch between supply and demand. CBO chose not to develop alternatives that would increase the supply of bandwidth after it analyzed two such approaches. Funding efforts to develop new technology is probably not feasible because the Army's planned new communications programs are already adopting all current and projected advances in technology. Increasing capacity by purchasing more equipment is also problematic. For example, some Army experts have suggested that projected bandwidth demand can be met by purchasing 20 times more sets of WIN-T equipment than the service is now planning to buy. Unfortunately, the current cost estimates for the WIN-T program already range between $4 billion and $9 billion, and additional spending of that magnitude may simply be an unlikely prospect.[36]

The CBO concluded that the best course of action is to find ways to eliminate lower-priority demand for bandwidth and better manage the demand that remains. Finally the Army should look at adopting software tools, some of which are starting to become commercially available, that could allow better management of the demand for bandwidth when it exceeded supply. These solutions seem simplistic for, what is in all other respects, a highly complex problem. The important consideration is that, just as the great armies of Napoleon were hindered by logistics, transformation initiatives, such as assured mobility, are only possible through the support of robust, reliable information networks.

Sensor Reliability

As discussed earlier in Chapter 2, the mobility COP is built from a myriad of inputs. The most recent and location-specific information comes from imbedded sensor inputs. While the task of building a sensor network is formidable, the reliability of the information is just as key. The functionality of current networks is highly susceptible to environmental conditions. For example, the technology of seismic and acoustic sensors shows great promise to support the BLOS and NLOS requirements but adverse meteorological conditions, such as high winds and snow cover, can severely degrade acoustic performance. Similarly, local geology influences from inhomogeneous materials, refraction, and diffraction have a significant influence seismic

[36]Douglas Holtz-Eakin, "The Army's Bandwidth Bottleneck," Congressional Budget Office Report, August 2003, http://www.cbo.gov/showdoc.cfm?index=4500&sequence=0.

sensitivities. The effectiveness of infrared (IR) sensors is also dependant on the environment since the surface temperature of terrain, soil, vegetation, and structures dictate the background contrast for infrared IR sensors and viewers. Local meteorological conditions can create significantly large amplitude, short duration fluctuations. The diurnal pattern creates IR crossover in the target background twice a day and rain also tends to "washout" the background. Just as with planning UAV missions, staffs must be able to forecast when and where to expect optimal sensor performance and know when to accept risk.

These are just a few of the issues and impacts that technology has to overcome to bring the dependability of sensors to a manageable level. The additional complexity of the urban environment and the potential weather extremes of likely areas of operations compound the difficulties that will be encountered by the future force. From battlespace environment data acquisition, exploitation, management, representation, and dissemination, to the physical modeling and forecasting the state of the physical environment, the challenges are significant. The capabilities required to overcome these challenges include:

Collection and integration of high-resolution geospatial data and comprehensive battlespace environment information, including real-time collection of new data and supplementing existing data.

Sensor cueing and placement.

Stand-off wide area ISR.

Tailored, digitized, and usable battlespace environment data that is timely and compatible with the network-centric environment.

Actionable and scalable visualization products to mitigate the Threat's "home-court" advantage displayed either visually or in a form compatible with user needs.

Computer-aided analysis and reasoning tools capable of prediction and understanding and that provide actionable advice.

Reach to national and other sources.

Data storage, retrieval and update capabilities.

Select, Establish, And Maintain Operating Areas

Just as important as maintaining the mobility COP is to provide the analysis required to make the battlespace picture a tool for planning. It provides the critical link between seeing first and understanding first. This analysis will better tailor the picture and assist in distinguishing the threat capabilities and intentions. Steps in the process include identifying the named areas of interest (NAIs), targeted areas of interest (TIAs), choke points, operating areas, and lines of communication (LOCs).

Information Overload

As discussed throughout the paper, information dominance is the cornerstone of assured mobility. Caution must be taken so that information dominance does not result in information overload. Throughout history commanders were plagued with the difficulties of receiving accurate battlefield information to weigh in their decision-making. Future commanders may be overloaded with excessive information from every imaginable source and in mind-numbing detail. The human decision-making process degrades under stress and time compression. With the existence of overwhelming data, the human brain will undertake automatic filtering. Only a small subset of data will be considered, thereby affecting the decision-making process. Part of the challenge in providing assured mobility is to design a system where the mobility COP is presented in such a way as to remain within the limits of human cognitive abilities.[37]

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[37]Alan D. Zimm, "Human Centric Warfare," *US Naval Institute Proceedings*, vol. 125, iss. 5, (May 1999) 30.

Success in providing assured mobility requires methods of presenting the mobility COP in an understandable manner that allows commanders to continue to use their intuition, experience, and education. Futurists are analyzing new approaches to present the volumes of information expected in future warfare. Theorists, such as Gary Klein,[38] are studying how information-based military concepts, like assured mobility, deliver timely information to commanders in an intuitive fashion so that the commander can formulate the correct decision. In the age of network centric warfare, commanders are enabled through networked knowledge systems drawing information from database worldwide. Finding the right method for displaying this data will present them with the best, if even incomplete, set of facts of a conflict situation from which they can make an intuitive decision.[39] Researchers like Klein are analyzing which stimuli spark the commander's intuitive reasoning and through what senses those stimuli are best delivered.[40] These initiatives are not new. They began with the wide spread emergence of computers and voluminous flow of information that those systems provide. In response, George Robertson in 1993, then of Xerox PARC, coined the term "information visualization" to define his interactive techniques of using aspects of imaging and graphics to transform data, information, and knowledge into a form that relies on the human visual system to perceive its

[38]Gary Klein, Chief Scientist at Klein Associates, Inc., a research and development firm that focuses on decision-making. Klein is author of *Sources of Power: How People Make Decisions* and *Intuition at Work.* This latest work is devoted to the question of how to design IT that supports rather than interferes with intuitive decision-making.

[39]Anthony J. Russo, "Leadership in the Information Age," *Military Review*, May-June 1999, vol. 79, no. 3. 79.

[40]Jef Albright, "Exploring Intuitive Decision Making," http://www.jefallbright.net/node /view/2453, web site accessed February 2004.

meaning.[41] Information visualization turns the avalanche of raw data into a means of faster and easier comprehension while supporting intuitive reasoning.

The Marine Corps is struggling with this same issue. Brig Gen. Jerry McAbee, Deputy Commander of Marine Forces Pacific, offers the warfighter's view to a system that may be years or even decades away from reality. "Instead of trying to deliver a perfect picture of the battlefield, we need to shift from that because the battlefield is chaotic and commanders are trained early on in their careers to make decisions based on their experience, intelligence and intuition."[42] Klein concurs with the Marine Corps' vision of developing information technology that support intuitive decision-making, but acknowledges that such a system will take time to accomplish. "I think there are actions that can be taken in the near future to make the technology more compatible with intuition, but the more comprehensive design Gen. McAbee is describing will take decades and some breakthroughs."[43] He goes on to state that information overload is the main challenge with the intuitive approach that the Marine Corps advocates.

Present theories for network centric warfare envision application of decision tools and artificial intelligence filters to reduce the impact of information overload. Klein believes that such moves may be counterproductive. Klein stated, "Some of the common approaches to solve this problem may actually make it worse--using artificial intelligence to do the searching will only reduce the decisionmaker's intuitive feel for the data,"

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[41]Nahum Gershon, "The Oldest Art Helps New Science," http://www.mitre.org/news/digest/archives/2002/storytelling.html, accessed in March 2004.

[42]Jef Albright, "Exploring Intuitive Decision Making," http://www.jefallbright.net/node/view/2453, web site accessed February 2004.

[43]Ibid.

Attack The Enemy's Ability To Influence Operating Areas

Once it is possible to identify and observe decisive terrain, it is then possible to allocate combat power and sensors to eliminate the enemy's ability to impede friendly maneuver. Reducing the enemy's ability to influence operating areas is a key enabler for mobility. This ensures freedom of maneuver by shaping the noncontiguous operating area by maintaining mobility for decisive operations.

Standoff Detection and Neutralization

A proactive attack of the enemy's ability to employ obstacles eliminates their ability to shape the AO against friendly forces. Attacking obstacles in coordination with the maneuver plan through the standoff detection and neutralization of obstacles is critical to preserve resources. Providers of assured mobility can no longer detect mines through the use of hand-held detection devices. Much research is being done on remote mine detection from a variety of platforms. Standoff obstacle detection is critical for mobility providers. The answer to this capability is probably not another piece of specialized engineer equipment. A better solution may come in the form of a specially designed UAV or some other aerial capability, similar to that of the helicopter-mounted Volcano system. The same is recommended for contamination avoidance. This paper did not address the assured mobility implications of CBRN (chemical, biological, radiological, and nuclear) obstacles but clearly, the ability to detect contamination from a distance is a desired capability and fits into the assured mobility framework. The best means of avoiding contamination is to know precisely where it is, and to avoid those locations.

Temporal Advantages

The current and future threats are changing in the terms of the tools employed. State-of-the-art technology is driven increasingly by commercial imperatives. Future enemies will employ commercial-off-the-shelf technology and "open" architectures. It may be argued that whatever advantages conferred by the information-based assured mobility framework are, at best, temporal. Advanced technology tools with military applications, such as secure communications, global positioning data, high resolution earth observation satellites, and computing technology, are proliferating at such a rate that a future adversary may possess presently inaccessible capabilities. The challenge to the enemy will be one of financial affordability rather than effective access denial.[44] History is full of prophets who proclaimed that the latest weapon would be the final pre-eminent "silver bullet" to defeat all other forces. Yet, counter-measures have inevitably appeared for every innovation or capability differential.

Maintain Mobility and Momentum

By acting in concert with all Battlefield Operating System (BOS) capabilities to protect the freedom of maneuver, friendly forces are able to neutralize the effects of enemy obstacles. This allows the seizure of objectives immediately and along multiple routes. Forces are able to maintain pressure and lethality as enemy threats are eliminated.

Engineers in the UA

A marked difference between the current configurations of the Stryker brigade the UA is the absence of the engineer company. Given the importance of providing assured mobility enablers, the Future Force UA must have, at a minimum, a commensurate engineer capability. An engineer company does not organically possess the assets required to adequately support an SBCT or UA. Providing mobility support is a difficult role that requires orchestration and

[44]David Goimpert, "National Security in the Information Age," *Naval War College Review*, (Autumn 1998) 31.

practice of the combined arms team. Combat is not the time to begin orchestration, nor is there enough time to adequately practice given the requirement for rapid and responsive deployment.

Failure or delay in executing assured mobility will result in increased friendly force casualties. The risk is high. For these reasons, it is imperative that the engineer force responsible for mobility be an integral, embedded piece of the UA. Members of the UA and the engineer force responsible for mobility must be able to train together, day in and day out, in garrison and in the field. It is not recommended that a separate Engineer UA for mobility be created, and plugged-in to the Maneuver UA as needed. There is no substitute for habitual relationships and frequent associations gained by being a part of the same unit, especially in high-risk operations. Mobility requires precision between the combined arms team, and integral members of this team should be members of an integrated, cohesive unit.

Engineer Equipment

Serious consideration is required in the mobility equipment for both current and future forces. Part of the Army's transformation effort is identifying equipment that can be more easily sustained. The Future Combat System (FCS) is a positive step in that effort. The Engineer Squad Vehicle (ESV), a variant of the FCS, will provide the enablers of assured mobility with a common platform with their maneuver counterparts. The current heavy squad carrier, the M113 Armored Personnel Carrier (APC), is aged and well past its useful life. Mechanized infantry gave up the M113 in the early 1980s; yet, sappers still exclusively use the vehicle today.

Design parameters of the ESV should correct the deficiencies of current engineer equipment. It must be able to carry all of the organic sapper squad table of organization (TOE) equipment without need for a trailer. The existing M105 Trailer for current forces is unsatisfactory. Additionally, the use of a trailer to carry TOE equipment or to tow equipment, such as the mine clearing line charge (MICLIC), greatly degrades the ability of the sapper to maintain pace with the maneuver forces. The degradation has resulted in maneuver forces creating other means to ensure their mobility, rather than waiting for the sappers to reach the breach site. The ESV should also have the capability for a mounted Volcano mine delivery system and modified MICLIC rocket. The modified MICLIC and Volcano mounting apparatus should be common to both systems and interchangeable. This also permits the commander the ability to tailor the number of mobility or counter-mobility assets to mission requirements.

Engineer equipment for mobility providers is woefully inadequate. Divisional combat engineers need to rid themselves of the antiquated, heavy equipment currently possessed. The M113 APC, the armored vehicle launched bridge (AVLB), the M9 armored combat earth mover (ACE), and the M548 Ammunition Carrier (currently provided by TOE to haul the Volcano) are cumbersome, far too heavy, and, most of all, not sustainable.

As discussed earlier, an intelligent lane marking system, integrated into the mobility COP is critical for assured mobility to the future force. A mounted ability to mark cleared lanes through obstacles must also be integrated into the ESV. The current method of dismounting engineers to mark the lane with poles, stakes, flags, cones, etc. is slow, cumbersome, and a significant force protection deficiency.

The ability to cross wet and dry obstacles will continue to be a requirement for mobility providers. The Rapidly Emplaced Bridge (REB) is currently the gap crossing system earmarked for the Future Force. The REB provides a 13-meter gap crossing capability for military load class (MLC) 30 vehicles. The REB is truck-mounted, has a crew of two soldiers capable of emplacing the bridge in less than five minutes. The REB is a significant enhancement to mobility options for engineer forces. The AVLB, on an M60 or M48 tank chassis, is no longer sustainable and obviously far too heavy for the Future Force. Improvements should be made in the REB design to enable launching the bridge on rough, sloped terrain, and the ability to span wet gaps. Currently, the REB can only span dry gaps.

Conclusion

Adopting a doctrine of assured mobility represents a fundamental change in the way mobility support is provided to maneuver forces. As evidenced from Operation Iraqi Freedom, assured mobility is possible now with current technology. The conceptual framework of assured mobility is providing the commander the improved ability to deploy, move, and maneuver where and when he desires, without interruption or delay, to achieve the mission. Additional capabilities from fielding the technology enablers discussed throughout this monograph will allow commanders better situational understanding and mobility. Designing, building, and fielding the equipment required for assured mobility may prove to be the costly, but comparatively easy step. The difficultly comes in having the right systems, experts, and organizations to transform the reams of data into actionable information. As a planning tool staffs need an assured mobility network that identifies "predict to detect," "detect to prevent," and "predict to prevent" linkages to develop predominate situational understanding and a marked advantage in maneuverability of the force. Success in assured mobility results when these linkages prevent the enemy from limiting friendly maneuver and protect the force from enemy effects.

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